**GOVT. P.G. COLLEGE FOR WOMEN, SECTOR-14, PANCHKULA**

**LESSON-PLAN (Session 2024-25) ODD SEMESTER**

**Name of Teacher**: Ms. Bindu

**Designation: Assistant Professor of Mathematics**

**Class: M. Sc.I**

**Subject/ Paper: Differential Equation I**

**Type of course( major/ minor/ VAC/ AEC/SEC/ MDC): Major**

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| **S. No.** | **Month** | **Topics to be covered** | **Teaching Learning Strategy** | **Learning Outcomes of Students** | **Remarks** |
| **1.** | **August** | Preliminaries: Initial value problem and equivalent integral equation, ε-approximate solution, equicontinuous set of functions. Basic theorems: Ascoli- Arzela theorem, Cauchy –Peano existence theorem and its corollary. Lipschitz condition. Differential inequalities and uniqueness, Gronwall’s inequality. Successive approximations. Picard-Lindelöf theorem. Continuation of solution, Maximal interval of existence, Extension theorem. Kneser’s theorem (statement only) | **Incorporate questions and discussions into lectures to engage students and encourage active participation.**  **Encourage students to work in groups to solve problems which promotes peer learning and communication skills** | **Perform qualitative analysis of differential equations, including stability analysis of equilibrium points and phase plane analysis analyse the behaviour of solutions and identify key properties such as stability, periodicity and bifurcations** |  |
| **2.** | **September** | Linear differential systems: Definitions and notations. Linear homogeneous systems; Fundamental matrix, Adjoint systems, reduction to smaller homogeneous systems. Non-homogeneous linear systems; variation of constants. Linear systems with constant coefficients. Linear systems with periodic coefficients; Floquet theory. (Relevant portions from the book of ‘Theory of Ordinary Differential Equations’ by Coddington and Levinson) |  | **1. Advanced Knowledge of Differential Equations:**  **- Demonstrate a deep understanding of ordinary differential equations (ODEs) and partial differential equations (PDEs), including their formulation and classification.**  **2. Analytical Techniques:**  **- Apply advanced analytical methods to solve linear and nonlinear differential equations.**  **- Understand and utilize the theory of existence and uniqueness of solutions for ODEs and PDEs.**  **Methodological Proficiency**  **3. Solution Techniques:**  **- Use various techniques such as separation of variables, integral transforms (Fourier and Laplace), and numerical methods to solve differential equations.**  **- Employ perturbation methods and asymptotic analysis for solving difficult differential equations.**  **4. Eigenvalue Problems:**  **- Solve eigenvalue problems associated with differential equations, including Sturm-Liouville theory and its applications** |  |
| **3.** | **October** | Higher order equations: Linear differential equation (LDE) of order n; Linear combinations, Linear dependence and linear independence of solutions. Wronskian theory: Definition, necessary and sufficient condition for linear dependence and linear independence of solutions of homogeneous LDE. Abel’s Identity, Fundamental set, More Wronskian theory. Reduction of order. Non-homogeneous LDE. Variation of parameters. Adjoint equations, Lagrange’s Identity, Green’s formula. Linear equation of order n with constant coefficients. |  | **Modeling with Differential Equations:**  **- Formulate and analyze mathematical models using differential equations to describe real-world phenomena in physics, biology, engineering, and other fields.**  **- Critically evaluate the assumptions and limitations of these models.**  **Numerical Methods:**  **- Implement numerical algorithms for solving differential equations using software tools such as MATLAB, Mathematica, or Python.**  **Critical Thinking and Problem Solving**  **Qualitative Analysis:**  **- Perform qualitative analysis of differential equations, including stability analysis of equilibrium points and phase plane analysis.**  **- Analyze the behavior of solutions and identify key properties such as stability, periodicity, and bifurcations.**  **Application of Theoretical Concepts:**  **- Apply theoretical concepts to solve complex, multi-step problems involving differential equations.**  **- Develop and validate new methods for solving difficult differential equations.** |  |
| **4.** | **November** | System of differential equations, the n-th order equation. Dependence of solutions on initial conditions and parameters: Preliminaries, continuity and differentiability. |  | **Mathematical Communication:**  **- Effectively communicate mathematical ideas, solutions, and proofs related to differential equations, both orally and in writing.**  **- Present research findings and complex solutions in a clear and concise manner.**  **Collaborative Skills:**  **Work effectively in teams to tackle complex problems involving differential equations, leveraging the strengths and insights of each team member.**  **Research Competence:**  **Independent research on topics related to differential equations, demonstrating the ability to identify research questions, review relevant literature, and apply appropriate methodologies.**  **Innovation and Creativity:**  **- Innovate and develop new approaches to solving differential equations, contributing to the advancement of mathematical knowledge and its applications.** |  |

* **Seminar/Presentation/Assignment/Quiz/Class Test /Mid-Term Exam will be taken as per schedule.**

**Signature of Teacher Principal**

**GOVT. P.G. COLLEGE FOR WOMEN, SECTOR-14, PANCHKULA**

**LESSON-PLAN (Session 2024-25) ODDSEMESTER**

**Name of Teacher**: Dr. Kiran Bala

**Designation:** Assistant Professor

**Class:** M.Sc I

**Subject/ Paper:** MM-402 : Real Analysis – I

**Type of course( major/ minor/ VAC/ AEC/SEC/ MDC): Non- NEP**

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| **S. No.** | **Month** | **Topics to be covered** | **Teaching Learning Strategy** | **Learning Outcomes of Students** | **Remarks** |
| **1.** | **August** | Definition and existence of Riemann Stieltjes integral, properties of the integral, integration and differentiation, the fundamental theorem of integral calculus, integration by parts, integration of vectorvalued functions, rectifiable curves. | Learning through Problem Solving | Students will understand the existence of Riemann Stieltjes integral and its application in other fields. |  |
| 2. | **September** | Pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weirstrass M-test, Abel’s test and Dirichlet’s test for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann Stieltjes integration, uniform convergence and differentiation, existence of a real continuous nowhere differentiable function, equicontinous families of functions, Weierstrass approximation theorem | Learning through Problem Solving | Students will be able to apply tests for pointwise and uniform convergence. | Assignment I  Class Test I |
| **3.** | **October** | Functions of several variables : linear transformations, derivative in an open subset of Rn, chain rule, partial derivatives, directional derivatives, the contraction principle, inverse function theorem, Implicit function theorem, Jacobians, extremum problems with constraints, Lagrange’s multiplier method, derivatives of higher order, mean value theorem for real functions of two variables, interchange of the order of differentiation, differentiation of integrals. | Learning through Problem Solving | Students will be able to understand functions of several variables | Assignment II |
| **4.** | **November** | Power Series : Uniqueness theorem for power series, Abel’s and Tauber’s theorem, Taylor’s theorem, Exponential & Logarithmic functions, trigonometric functions, Fourier series, Gamma function ,Integration of differential forms, Partitions of unity, differential forms, Stokes theorem. | Learning through Problem Solving ,  Group- Learning and Teaching | Students will be able to understand Power Series and some related theorems. | Presentations |

* **Seminar/Presentation/Assignment/Quiz/Class Test /Mid-Term Exam will be taken as per schedule.**

**Signature of Teacher Principal**

**GOVT. P.G. COLLEGE FOR WOMEN, PANCHKULA**

**Session 2024-25(ODD SEMESTER)**

NAME OF PROFESSOR. Kanchan Bala

DESIGNATION. Associate professor

SUBJECT/PAPER Advanced abstract algebra

CLASS.M.Sc(Mathematics)1st sem

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| SR. NO | MONTH | TOPICS TO BE COVERED | LEARNING OUTCOMES OF STUDENTS & TEACHING LEARNING STRATEGY |
| 1. | August | Automorphisms and Inner automorphisms of a group G. The groups Aut(G) and Inn(G). Automorphism  group of a cyclic group. Normalizer and Centralizer of a non-empty subset of a group G. Conjugate  elements and conjugacy classes. Class equation of a finite group G and its applications. Derived group  (or a commutator subgroup) of a group G. perfect groups. Zassenhau’s Lemma. Normal and  Composition series of a group G. Scheier’s refinement theorem. Jordan Holder theorem. Composition  series of groups of order pn and of Abelian groups. Caunchy theorem for finite groups. ∏ - groups and  p-groups. Sylow ∏-subgroups and Sylow p-subgroups. Sylow’s Ist, IInd and IIIrd theorems.  Application of Sylow theory to groups of smaller orders. | Have deep understanding and knowledge in the core areas of Mathematics and demonstrate understanding and application of the concepts/theories/principles/ methods/ techniques in different areas of pure Mathematics.  Through  Group learning and teaching, learning through problem solving. |
| 2. | September | Characteristic of a ring with unity. Prime fields Z/pZ and Q. Field extensions. Degree of an extension.  Algebraic and transcendental elements. Simple field extensions. Minimal polynomial of an algebraic  element. Conjugate elements. Algebraic extensions. Finitely generated algebraic extensions. Algebraic  closure and algebraically closed fields. Splitting fields., finite fields.. Normal extensions. |  |
| 3. | October | Separable elements, separable polynomials and separable extensions. Theorem of primitive element.  Perfect fields. Galois extensions. Galois group of an extension. Dedekind lemma Fundamental theorem  of Galois theory. Frobenius automorphism of a finite field. Klein’s 4-group and Diheadral group.  Galois groups of polynomials. Fundamental theorem of Algebra. |  |
| 4. | November  December | Solvable groups Derived series of a group G. Simplicity of the Alternating group An (n>5). Non  solvability of the symmetric group Sn and the Alternating group An (n>5). Roots of unity Cyclotomic  polynomials and their irreducibility over Q Radicals extensions. Galois radical extensions. Cyclic  extensions. Solvability of polynomials by radicals over Q. Symmetric functions and elementary  symmetric functions. |  |

**TWO ASSIGNMENTS AND ONE UNIT TEST WILL BE TAKEN AS PER SCHEDULE**.

Signature of A/Prof .

**GOVT. P.G. COLLEGE FOR WOMEN, SECTOR-14, PANCHKULA**

**LESSON-PLAN (Session 2024-25) ODD SEMESTER**

**Name of Teacher**: Raj Singh

**Designation: ASSISTANT PROFESSOR**

**Class: M.Sc. 1 Sem.1**

**Subject/ Paper: REAL ANALYSIS**

**Type of course:(NEP):**

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| **S. No.** | **Month** | **Topics to be covered** | **Teaching Learning Strategy** | **Learning Outcomes of Students** | **Remarks** |
| **1.** | **AUGUST** | Definition and existence of Riemann Stieltjes integral, properties of the integral, reduction of Riemann Stieltjes integral to ordinary Riemann integral, change of variable, integration and differentiation, the fundamental theorem of integral calculus, integration by parts, first and second mean value theorems for Riemann Stieltjes integrals, integration of vector-valued functions, rectifiable curves. (Scope as in Chapter 6 of ‘Principles of Mathematical Analysis’ by Walter Rudin, Third Edition). Sequences and series of functions : Pointwise and uniform convergence of sequences of functions, | Peer teaching | After completing this course students will be able to understand basic concepts and genesis of Pointwise and uniform convergence of sequences of functions, | **Assignment** |
| **2.** | **SEPT.** | Functions of several variables : Linear transformations, the space of linear transformations on Rn to Rm as a metric space, open sets, continuity, derivative in an open subset of Rn, chain rule, partial derivatives, directional derivatives, continuously differentiable mappings, necessary and sufficient conditions for a mapping to be continuously differentiable, contractions, the contraction principle (fixed point theorem), the inverse function theorem, the implicit function theorem. (Scope as in relevant portions of Chapter 9 of ‘Principles of Mathematical Analysis’ by Walter Rudin, Third Edition) Power Series : Uniqueness theorem for power series, Abel’s and Tauber’s theorem, |  | To understand the concepts of directional derivatives, continuously differentiable mappings, | **Presentations** |
| **3.** | **OCT.** | Cauchy criterion for uniform convergence, Dini’s theorem, uniform convergence and continuity, uniform convergence and Riemann integration, uniform convergence and differentiation, convergence and uniform convergence of series of functions, Weierstrass M-test, integration and differentiation of series of functions, existence of a continuous nowhere differentiable function, the Weierstrass approximation theorem, the Arzela theorem on equicontinuous families. (Scope as in Chapter 9 (except 9.6) & Chapter 10 (except 10.3) of ‘Methods of Real Analysis’ by R.R. Goldberg). |  | To help students to understand the aspects of existence of a continuous nowhere differentiable function, | **Class Test** |
| **4.** | **NOV.** | Taylor’s theorem, Exponential & Logarithmic functions, trigonometric functions, Fourier series, Gamma function (Scope as in relevant portions of Chapter 8 of ‘Principles of Mathematical Analysis’ by Walter Rudin, Third Edition). |  | To understand the concepts of Fourier series, Gamma function |  |

**Seminar/Presentation/Assignment/Quiz/Class Test /Mid-Term Exam will be taken as per schedule.**